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(54) CHASSIS VEHICLE CLOSING AND LOCKING APPARATUS

(57) The present disclosure provides a closing and locking apparatus for a chassis cart comprising a closing and locking unit (5). The closing and locking unit (5) comprises a support plate (501), a latching plate (502), and an extension spring (503), wherein one end of the extension spring (503) is secured on the latching plate (502), and the other end thereof is secured on the support plate (501). The support plate (501) comprises a first limiting plate (5011) and a second limiting plate (5012); the latching plate (502) is rotatably secured onto a rotation shaft (5015) and, under the action of a driving plate (4), rotates clockwise or anticlockwise about the rotation shaft (5015). When the latching plate (502) rotates to be limited by the first limiting plate (5011), the driving plate (4) is separated from the closing and locking unit (5); and when the latching plate (502) rotates to be limited by the second limiting plate (5012), the driving plate (4) comes in contact with the closing and locking unit (5). The resetting of the driving plate (4) will drive the closing and locking unit (5) to rotate, about the rotation shaft (5015), away from the second limiting plate (5012) toward the first limiting plate (5011).

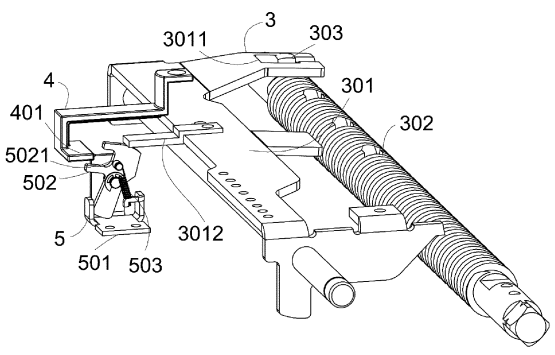

FIG. 2

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Description

FIELD

[0001] The present disclosure relates to the technical field of electrical power products, and specifically to the technical field of high-voltage switching devices, and particularly to a chassis cart apparatus for a high-voltage switch circuit breaker.

BACKGROUND

[0002] Switching devices are used as protection devices in power systems, and its safety during operation is particularly important. As one interlock in five locks and one key, it is required that the chassis cart cannot be rocked in and out in a closing state of the switching device. This may prevent the operator from operating the switching device in the event of by mistake so that the protective function may still be achieved.

[0003] However, the existing known technology of closing and locking the chassis cart directly adopts an interlocking mechanism triggered by an actuator of the switching device to implement stop of and yield to a flipper plate of the chassis cart. When the switching device is closed, the actuator drives three-phase contacts to perform a closing action, and meanwhile drives the interlocking mechanism of the chassis cart to move to a specified position, thereby stopping the flipper plate of the chassis cart. When the switching device is opened, the actuator drives the three-phase contacts to perform an opening operation, and meanwhile drives the interlocking mechanism to move in an opposite direction to yield to the flipper plate of the chassis cart.

[0004] FIGS. 1A and 1B show a conventional closing and locking apparatus for a chassis cart, wherein FIG. 1A is a perspective view and FIG. 1B is a front view. The figures show a closing state of the closing apparatus of the chassis cart, which includes a vertically-movable pivot 101, a link 102, a first locking link 201, a second locking link 202, a locking and fixing pin 203, a locking stopper 204, and a flipper plate 301 and a screw 302 on the chassis cart.

[0005] The movable pivot 101 implements the opening and closing operation of the switch, and thereby brings the first locking link 201 to move vertically via the link 102; the second locking link 202 is fixedly connected together with the locking stopper 204, and may rotate about the locking and fixing pin 203, and the locking and fixing pin 203 is not affected by other movement members. Meanwhile, the second locking link 202 is connected with the first locking link 201. As such, driven by the first locking link 201, the locking stopper 204 may rotate. When the switching device is in the closing position, the locking stopper 204 rotates to above a tongue 3013 of the flipper plate 301 with a small gap therebetween.

[0006] However, this kind of interlocking mechanism has the following drawbacks: when the switching device is closed, if the chassis cart is driven, due to the stopping function of the interlocking mechanism the restoring force of the flipper plate on the chassis cart directly acts on the interlocking mechanism, and thereby acts on the actuator of the switching device, which imposes a risk of the opening of the actuator. In addition, the conventional chassis cart closing and locking apparatus is complicated in both structure and assembling.

SUMMARY

[0007] To address the drawbacks and problems existing in the chassis cart closing and locking apparatus in the prior art, the present disclosure provides a closing and locking apparatus for a chassis cart comprising a closing and locking unit; the closing and locking unit comprising a support plate, a latching plate and an extension spring; one end of the extension spring is secured on the latching plate, and the other end thereof is secured on the support plate; the support plate comprises a first limiting plate and a second limiting plate; the latching plate is rotatably secured onto a rotation shaft and, under the action of a driving plate, rotates clockwise or anticlockwise about the rotation shaft; when the latching plate rotates to be limited by the first limiting plate, the driving plate is separated from the closing and locking unit; and when the latching plate rotates to be limited by the second limiting plate, the driving plate comes in contact with the closing and locking unit, and the resetting of the driving plate drives the closing and locking unit to rotate, about the rotation shaft, away from the second limiting plate toward the first limiting plate.

[0008] According to a preferred embodiment of the present disclosure, a height and width of the latching plate are adapted in a way that when the latching plate is rotated to be limited by the first limiting plate, the latching plate is located below a protruding piece, and blocks downward movement of the protruding piece; when the latching plate is rotated to be limited by the second limiting plate, the latching plate gets out of a limiting range of the vertical movement of the protruding piece.

[0009] According to a preferred embodiment of the present disclosure, the driving plate moves up and down along with a closing or opening operation of the switching device actuator, thereby driving the latching plate to rotate clockwise or counterclockwise.

[0010] According to a preferred embodiment of the present disclosure, the latching plate has a dead point position between the first limiting plate and the second limiting plate, and the tension spring achieves a maximum tensile energy storage when it is at the dead point position.

[0011] According to a preferred embodiment of the present disclosure, the latching plate comprises a U-shaped groove, which is adapted to receive a driving plate protrusion and is driven by the driving plate, and the latching plate rotates clockwise or counterclockwise about the rotation shaft between the first limiting plate

and second limiting plate.

[0012] According to a preferred embodiment of the present disclosure, the U-shaped groove comprises a first protrusion and a second protrusion; the first protrusion is adapted in a way that the latching plate, when limited by the first limiting plate, is driven by the driving plate about the rotation shaft until the latching plate reaches the limiting position of the second limiting plate; the second protrusion is adapted in a way that the latching plate, when limited by the second limiting plate, is driven by the driving plate about the rotation shaft until the latching plate reaches the limiting position of the first limiting plate.

[0013] According to a preferred embodiment of the present disclosure, the driving plate comprises a driving plate protrusion which is adapted to mate with the U-shaped groove of the latching plate; when the latching plate reaches the position of the first limiting plate or the position of the second limiting plate, the driving plate protrusion is released from the U-shaped groove if the driving plate continues to move in the same direction, and drives the latching plate if it moves in a reverse direction.

[0014] According to a preferred embodiment of the present disclosure, the latching plate comprises a raised pin, and the support plate comprises a spring hook; one end of the tension spring is fixed on the raised pin, and the other end thereof is fixed on the spring hook.

[0015] According to a preferred embodiment of the present disclosure, when the latching plate rotates to a position at which the raised pin, the spring hook and the rotation shaft form a straight line, the latching plate reaches the dead point position.

[0016] According to a preferred embodiment of the present disclosure, the closing and locking apparatus further comprises a flipper plate and screw mechanism including a flipper plate, a screw and a stop pin; the flipper plate comprises a yielding hole which may mate with stop pin to lock or yield.

[0017] According to a preferred embodiment of the present disclosure, the protruding piece and the flipper plate are an integrated structure or a separable structure connected fixedly.

[0018] The closing and locking apparatus for the chassis cart according to the present disclosure is safer, and particularly the force for driving the chassis cart in or out will not be applied to the actuator of the switching device; furthermore, the closing and locking apparatus for the chassis cart is simply structured and modularized, and saves the assembling time.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

FIGS. 1A-1B illustrate schematic structural diagrams of a conventional chassis cart closing and locking apparatus; wherein FIG. 1A is a perspective view, and FIG. 1B is a front view;

FIG. 2 illustrates a schematic structural diagram of a closing and locking apparatus for a chassis cart according to a preferred embodiment of the present disclosure;

FIG. 3 illustrates a schematic structural diagram of a locking unit of a closing and locking apparatus for a chassis cart according to a preferred embodiment of the present disclosure;

FIG. 4 illustrates a schematic diagram of the chassis cart closing and locking apparatus locking the chassis cart according to a preferred embodiment of the present disclosure;

FIGS. 5A-5B illustrate schematic diagrams of the chassis cart closing and locking apparatus releasing the chassis cart according to a preferred embodiment of the present disclosure, wherein FIG. 5A is a front view and FIG. 5B is a perspective view.

DETAILED DESCRIPTION

[0020] Detailed depictions of optional embodiments of the present disclosure are presented below with reference to the figures.

[0021] FIG. 2 is a schematic configuration diagram showing a chassis cart closing and locking apparatus with a dead point position according to the present disclosure, and the figure shows a state in which an actuator of a switching device is closed. The chassis cart closing and locking apparatus of the present disclosure comprises a closing and locking unit 5. The closing and locking unit 5 comprises a support plate 501, a latching plate 502 and an extension spring 503. One end of the extension spring 503 is secured on the latching plate 502, and the other end thereof is secured on the support plate 501. The support plate 501 comprises a first limiting plate 5011 and a second limiting plate 5012. The latching plate 502 is rotatably secured onto a rotation shaft 5015 and, under the action of a driving plate 4, rotates clockwise or anticlockwise around the rotation shaft 5015. When the latching plate 502 rotates to be limited by the first limiting plate 5011, the driving plate 4 is separated from the closing and locking unit 5; and when the latching plate 502 rotates to be limited by the second limiting plate 5012, the driving plate 4 comes into contact with the closing and locking unit 5. The resetting of the driving plate 4 drives the closing and locking unit 5 to rotate about the rotation shaft 5015 away from the second limiting plate 5012 toward the first limiting plate 5011.

[0022] According to a preferred embodiment of the present disclosure, a flipper plate 301 has a yielding hole 3011 that can mate with a stop pin 303 to implement the locking or yielding function; a feature protruding piece 3012 on the flipper plate 301 is used for engaging with the latching plate 502 of the closing and locking unit 5 to implement the latching or yielding function. The protrud-

ing piece 3012 may be integrally formed with the flipper plate 301 or may be fixedly connected with the flipper plate 301 to form one piece.

[0023] According to a preferred embodiment of the present disclosure, a height and width of the latching plate 502 are adapted in a way that when the latching plate 502 is rotated to be limited by the first limiting plate 5011, the latching plate 502 is located under the protruding piece 3012 and blocks downward movement of the protruding piece 3012; when the latching plate 502 is rotated to be limited by the second limiting plate 5012, the latching plate 502 gets out of a limiting range of the vertical movement of the protruding piece 3012.

[0024] The driving plate 4 is coupled to the actuator of the switching device, and moves up or down with the closing or opening operation of the actuator of the switching device, thereby driving the latching plate 502 to rotate clockwise or counterclockwise.

[0025] According to a preferred embodiment of the present disclosure, the latching plate 502 has a dead point position between the first limiting plate 5011 and the second limiting plate 5012, and the tension spring 503 achieves a maximum tensile energy storage when at the dead point position.

[0026] The latching plate 502 comprises a raised pin 5022, and the support plate 501 comprises a spring hook 5013. One end of the tension spring 503 is fixed on the raised pin 5022, and the other end thereof is fixed on the spring hook 5013.

[0027] When the latching plate 502 rotates to a position at which the raised pin 5022, the spring hook 5013 and the rotation shaft 5015 form a straight line, the latching plate 502 reaches the dead point position.

[0028] As shown in FIG. 2, the chassis cart closing and locking apparatus of the present disclosure further comprises a flipper plate and screw mechanism 3, which comprises a flipper plate 301, a screw 302 and a stop pin 303. The flipper plate 301 comprises a yielding hole 3011, which may mate with stop pin 303 to lock or yield.

[0029] According to a preferred embodiment of the present disclosure, the protruding piece 3012 and the flipper plate 301 are an integrated or a separable structure connected fixedly.

[0030] FIG. 3 is a schematic structural diagram of a locking unit of a chassis cart closing and locking apparatus according to a preferred embodiment of the present disclosure. As illustrated, a support plate 501 has a first limiting plate 5011 and a second limiting plate 5012 for limiting the clockwise and counterclockwise rotation angle of the latching plate 502 respectively; a spring hook 5013 is used to fix one end of the tension spring 503; at least one fixing hole 5014 is used for fixedly connecting the support plate 501 to a bottom plate of the chassis cart; the raised pin 5022 on the latching plate 502 is used to fix the other end of the tension spring 503; the latching plate 502 is rotated about a rotation shaft 5015 on the support plate 501.

[0031] The latching plate 502 comprises a U-shaped groove 5021, which is adapted to receive a driving plate protrusion 401 and is driven by the driving plate 4. The latching plate 502 rotates clockwise or counterclockwise about the rotation shaft 5015 between the first limiting plate 5011 and second limiting plate 5012.

[0032] The U-shaped groove 5021 comprises a first protrusion 50211 and a second protrusion 50212; the first protrusion 50211 is adapted in a way that the latching plate 502, when limited by the first limiting plate 5011, is driven by the driving plate 4 about the rotation shaft 5015 until the latching plate 502 reaches the limiting position of the second limiting plate 5012; the second protrusion 50212 is adapted in a way that the latching plate 502, when limited by the second limiting plate 5012, is driven by the driving plate 4 about the rotation shaft 5015 until the latching plate 502 reaches the limiting position of the first limiting plate 5011.

[0033] The driving plate 4 comprises the driving plate protrusion 401 which is adapted to mate with the U-shaped groove 5021 of the latching plate 502 to be snapped into the U-shaped groove 5021. When the actuator of the switching device performs the closing or opening operation,, the driving plate 4 moves up and down with the actuator of the switching device, to drive the latching plate 502 to implement clockwise or counterclockwise rotation When the latching plate 502 reaches the limiting position of the first limiting plate 5011 or the limiting position of the second limiting plate 5012,, the driving plate protrusion 401 is released from the U-shaped groove 5021 if the driving plate 4 continues to move in the same direction, and drives the latching plate 502 if the driving plate 4 moves in the reverse direction.

[0034] Hereinafter, description will be made to the working principle of the chassis cart closing and locking apparatus according to the present disclosure will be described below.

[0035] FIG. 4 is a schematic diagram of the chassis cart closing and locking apparatus locking the chassis cart according to a preferred embodiment of the present disclosure. When the actuator of the switching device is closed, the driving plate 4 moves with the actuator in the direction as shown, and triggers the U-shaped groove 502, so that the latching plate 502 rotates clockwise in the direction shown. Due a gap S between the protruding piece 3012 and the latching plate 502, the latching plate 502 may rotate to a position under the protruding piece 3012, and the rotation angle is controlled by the first limiting plate 5011. Under the action of the tension by the tension spring 503, the latching plate 502 is stably retained at this position. When the action is completed, there is no any contact between the driving plate 4 and the closing and locking unit 5.

[0036] At this time, if the chassis cart is driven, the screw 302 rotates, and the flipper plate 301 tends to rotate counterclockwise in the direction shown by the arrow in the figure. However, since the protruding piece 3012 is stopped by the latching plate 502, the flipper plate 301 cannot rotate counterclockwise, and as shown in FIG. 2,

the stop pin 303 on the screw 302 is caught in the yielding hole 3011, so that the chassis cart cannot be driven. At the same time, because the driving plate 4 does not contact the latching plate 502, the force for driving the chassis cart will not be transferred to the actuator coupled to the driving plate 4.

[0037] FIGS. 5A-5B illustrate a preferred embodiment of the present disclosure, in which FIG. 5A is a front view and FIG. 5B is a perspective view. The figures show schematic diagrams when the chassis cart closing and locking apparatus releases the chassis cart. When the actuator of the switching device is in the opened state, the driving plate 4 moves downward by a certain distance along with the actuator in the direction shown, and triggers the U-shaped groove 5021 so that the latching plate 502 rotates counterclockwise in the direction shown and is limited by the second limiting plate 3012. Its stable state is maintained by the tension spring 503. At this point, the screw 302 is rotated and the flipper plate 301 may rotate counterclockwise to a certain angle still with a certain gap H between the protruding piece 3012 and the latching plate 502, and at the same time, the stop pin 303 will not be limited by the flipper plate 301. As such, the chassis cart may be driven.

[0038] According to the present disclosure, the chassis cart closing and locking apparatus with a dead point mechanism is safer than the existing design, and the force for driving the chassis cart in or out will not be applied to the actuator of the switching device. Furthermore, the chassis cart closing and locking apparatus is simply structured and modularized, and thus can save the assembling time. The chassis cart closing and locking apparatus also satisfies demands of the IEC-related standard.

[0039] Although the preferred embodiments and figures of the present disclosure have been disclosed for illustrative purposes, those skilled in the art can make various substitutions, changes and modifications without departing from the spirit and scope of the present disclosure and the appended claims. Therefore, the present disclosure should not be limited to the content disclosed in the above-mentioned preferred embodiments and figures illustrated as examples. The protection scope of the present disclosure is limited by the appended claims.

Claims

1. A closing and locking apparatus for a chassis cart, wherein the closing and locking apparatus comprises a closing and locking unit (5),
   the closing and locking unit (5) comprises a support plate (501), a latching plate (502) and an extension spring (503);
   the extension spring (503) has one end secured on the latching plate (502) and the other end secured on the support plate (501);
   the support plate (501) comprises a first limiting plate (5011) and a second limiting plate (5012);
   the latching plate (502) is rotatably secured onto a rotation shaft (5015) and, under the action of a driving plate (4), rotates clockwise or anticlockwise about the rotation shaft (5015);
   when the latching plate (502) rotates to be limited by the first limiting plate (5011), the driving plate (4) is separated from the closing and locking unit (5), and when the latching plate (502) rotates to be limited by the second limiting plate (5012), the driving plate (4) comes in contact with the closing and locking unit (5), and the resetting of the driving plate (4) drives the closing and locking unit (5) to rotate about the rotation shaft (5015) away from the second limiting plate (5012) toward the first limiting plate (5011).

2. The closing and locking apparatus for the chassis cart according to claim 1, wherein a height and width of the latching plate (502) are adapted in a way that when the latching plate (502) is rotated to be limited by the first limiting plate (5011), the latching plate (502) is located under a protruding piece (3012) and blocks downward movement of the protruding piece (3012); and when the latching plate (502) is rotated to be limited by the second limiting plate (5012), the latching plate (502) gets out of a limiting range of the vertical movement of the protruding piece (3012).

3. The closing and locking apparatus of the chassis cart according to claim 1, wherein the driving plate (4) moves up and down along with a closing or opening operation of an actuator of the switching device, thereby driving the latching plate (502) to rotate clockwise or counterclockwise.

4. The closing and locking apparatus for the chassis cart according to claim 1, wherein the latching plate (502) has a dead point position between the first limiting plate (5011) and the second limiting plate (5012), and the tension spring (503) achieves a maximum tensile energy storage when it is at the dead point position.

5. The closing and locking apparatus for the chassis cart according to claim 1, wherein the latching plate (502) comprises a U-shaped groove (5021) which is adapted to receive a driving plate protrusion (401) and is driven by the driving plate (4), and the latching plate rotates clockwise or counterclockwise about the rotation shaft (5015) between the first limiting plate (5011) and second limiting plate (5012).

6. The closing and locking apparatus for the chassis cart according to claim 5, wherein the U-shaped groove (5021) comprises a first protrusion (50211) and a second protrusion (50212); the first protrusion (50211) is adapted in a way that the latching plate (502), when limited by the first limiting plate (5011),

is driven by the driving plate (4) about the rotation shaft (5015) until the latching plate (502) reaches a limiting position of the second limiting plate (5012); the second protrusion (50212) is adapted in a way that the latching plate (502), when limited by the second limiting plate (5012), is driven by the driving plate (4) about the rotation shaft (5015) until the latching plate (502) reaches a limiting position of the first limiting plate (5011).

7. The closing and locking apparatus for the chassis cart according to claim 5, wherein the driving plate (4) comprises a driving plate protrusion (401) which is adapted to mate with the U-shaped groove (5021) of the latching plate (502); when the latching plate (502) reaches a limiting position of the first limiting plate (5011) or a limiting position of the second limiting plate (5012), the driving plate protrusion (401) is released from the U-shaped groove (5021) if the driving plate (4) continues to move in the same direction, and drives the latching plate (502) if the driving plate (4) moves reversely.

8. The closing and locking apparatus for the chassis cart according to claim 4, wherein the latching plate (502) comprises a raised pin (5022), and the support plate (501) comprises a spring hook (5013); one end of the tension spring (503) is fixed on the raised pin (5022), and the other end thereof is fixed on the spring hook (5013).

9. The closing and locking apparatus for the chassis cart according to claim 8, wherein when the latching plate (502) rotates to a position that the raised pin (5022), the spring hook (5013) and the rotation shaft (5015) form a straight line, the latching plate (502) reaches the dead point position.

10. The closing and locking apparatus for the chassis cart according to claim 1, wherein the closing and locking apparatus further comprises a flipper plate and screw mechanism (3) including a flipper plate (301), a screw (302) and a stop pin (303); and the flipper plate (301) comprises a yield hole (3011), which could mate with the stop pin (303) to lock or yield.

11. The closing and locking apparatus for the chassis cart according to claim 2, wherein the protruding piece (3012) and the flipper plate (301) are an integrated structure or a separable structure connected fixedly.

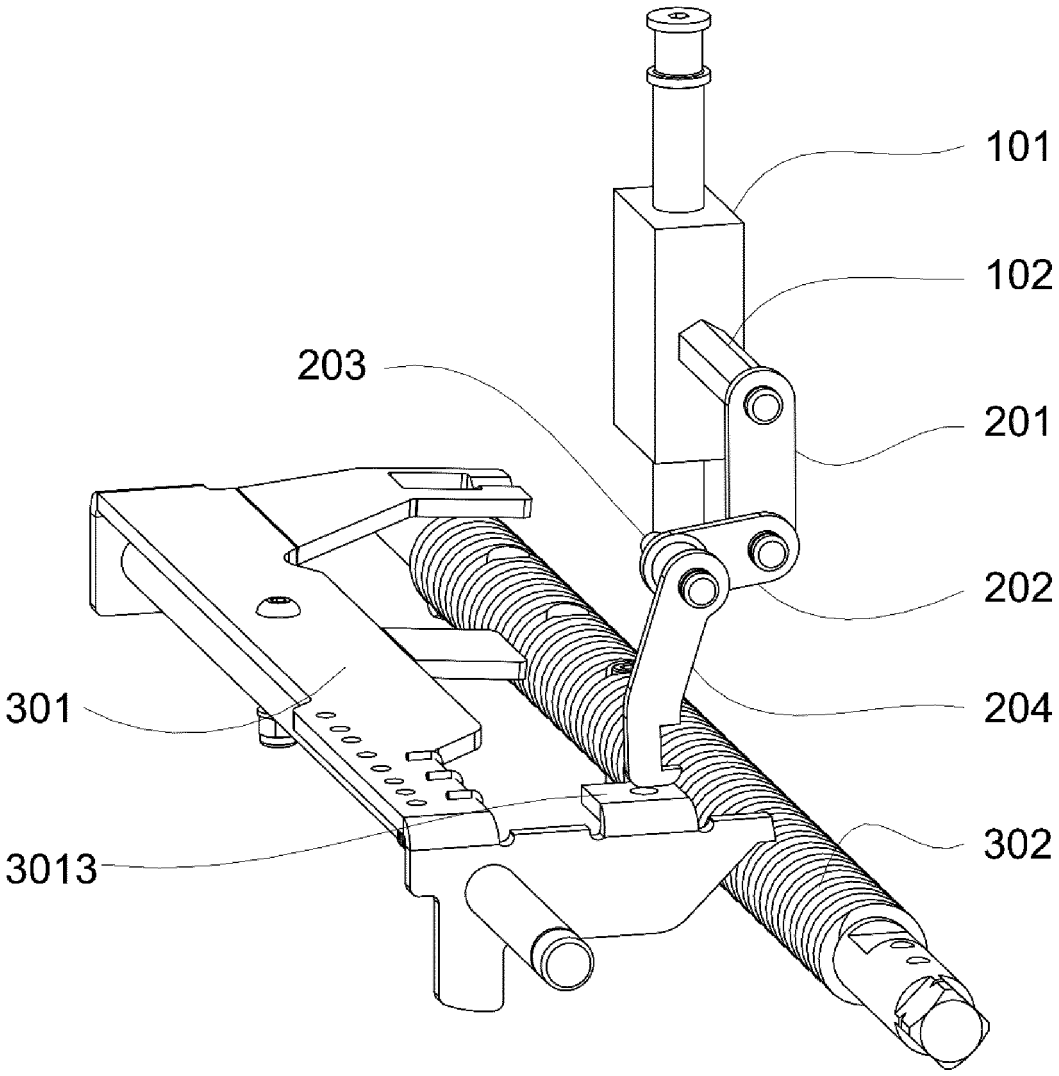

FIG. 1A

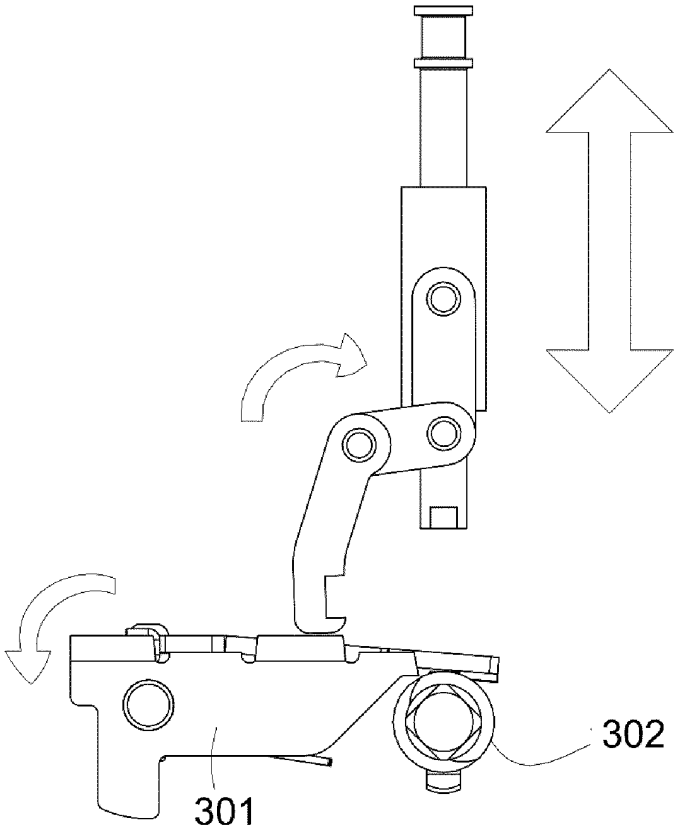

FIG. 1B

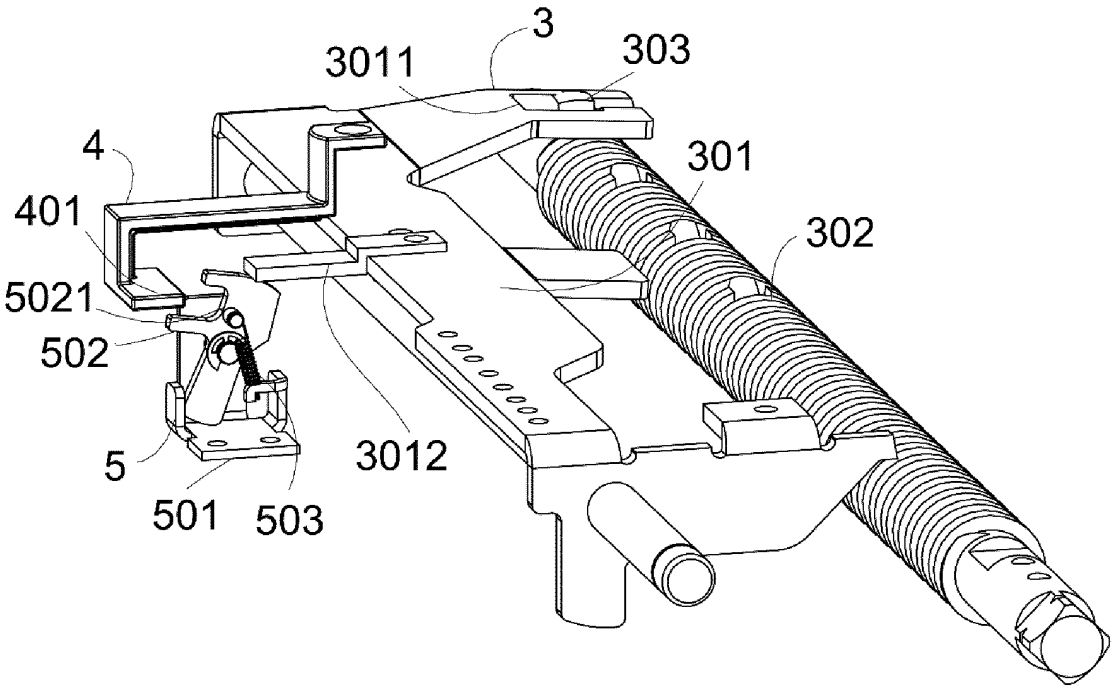

FIG. 2

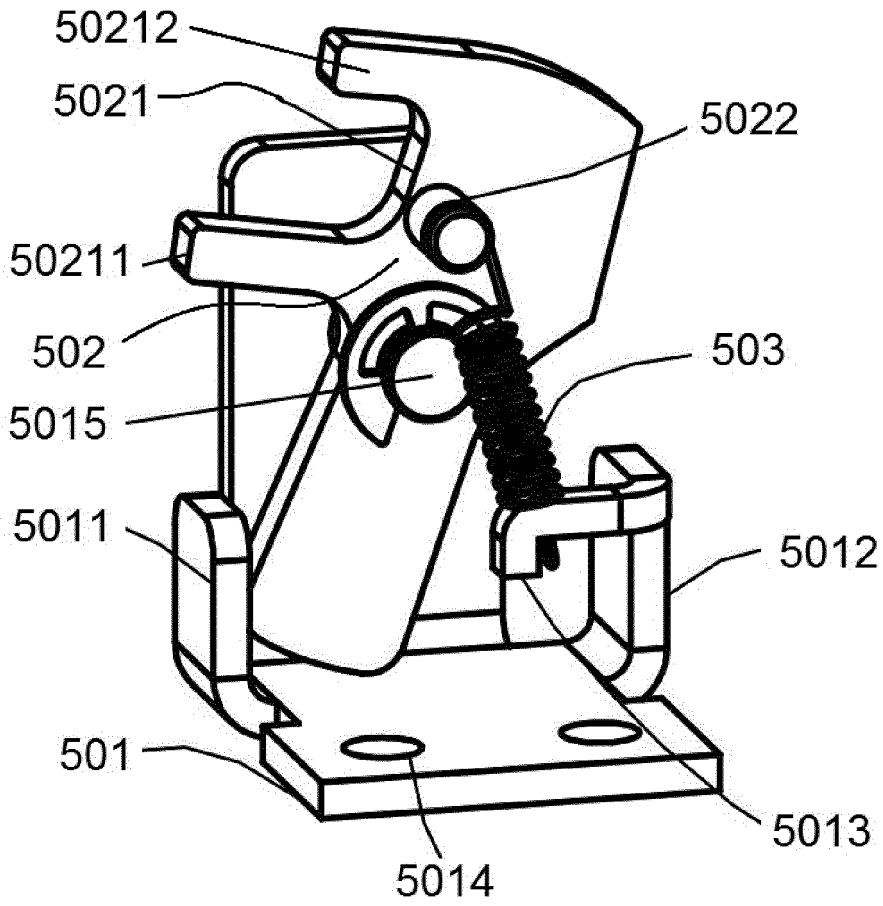
50212
5021
5022
50211
502
503
5015
5011
5012
501
5013
5014

FIG. 3

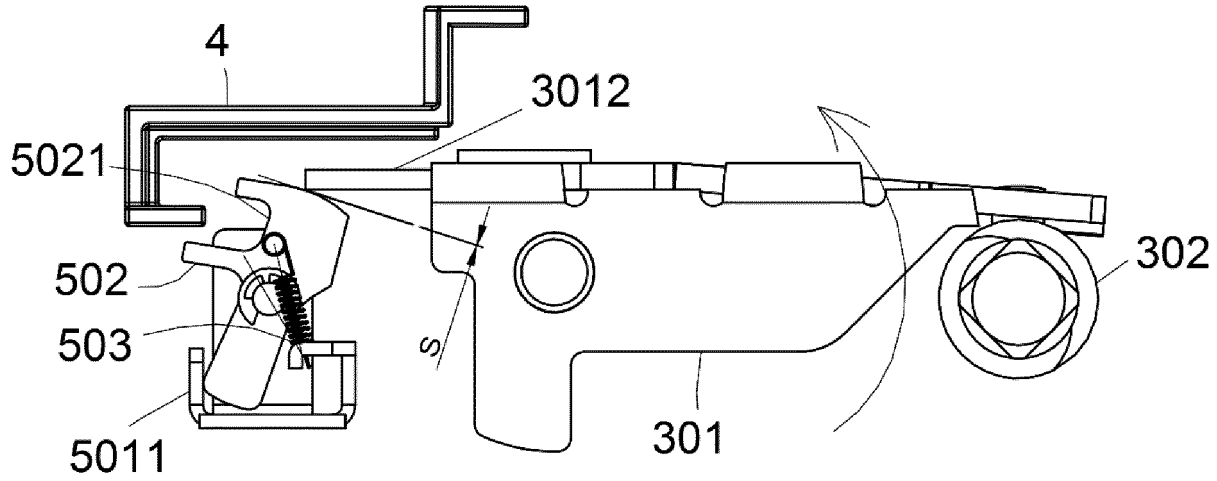
4
3012
5021
302
502
503
S
5011
301

FIG. 4

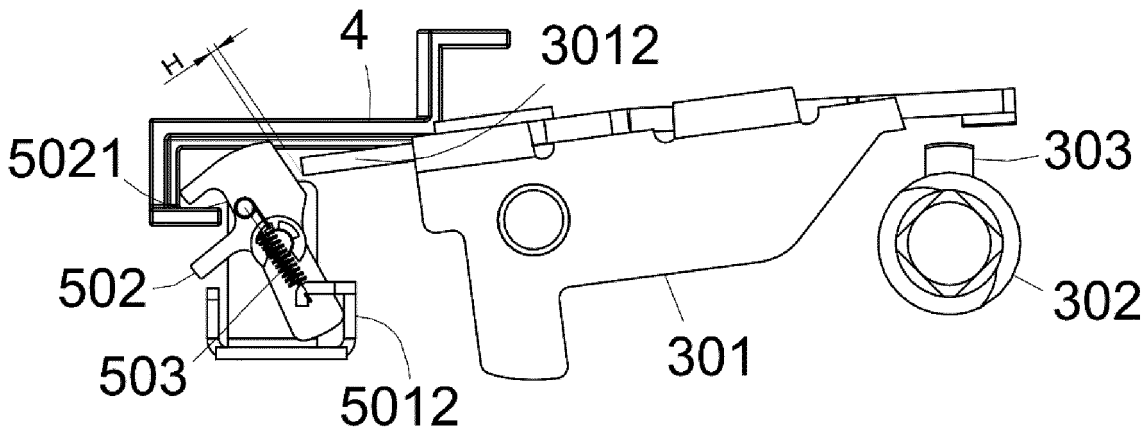

FIG. 5A

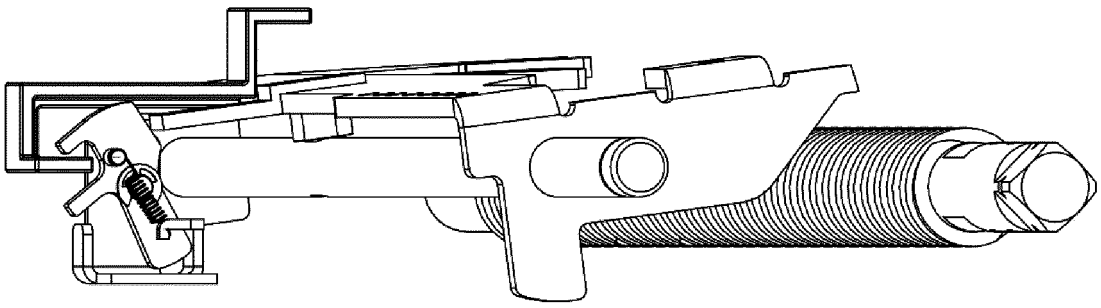

FIG. 5B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/092461

A. CLASSIFICATION OF SUBJECT MATTER

H02B 11/133 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H02B; H01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, EPODOC, CNPAT, CNKI: 底盘车, 电路器, 高压开关, 合闸, 闭锁, 支撑板, 锁扣板, 弹簧, 驱动板, 第一, 第二, 限位板, 分离, 间隔, 间距, 接触, 转轴, 制动器, 分闸, 翻板, 摇动, breaker, switch, interlocking, closing, latching, locking, elastic, spring, opening, turn off, rotating shaft, shake

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 204991537 U (SIEMENS LTD., CHINA) 20 January 2016 (20.01.2016), description, paragraphs [0042]-[0055], and figures 1-5	1-11
A	CN 205723388 U (ZHEJIANG CHINT ELECTRIC APPLIANCE CO., LTD.) 23 November 2016 (23.11.2016), entire document	1-11
A	CN 202997387 U (CHANGSHU SWITCHGEAR MANUFACTURING CO., LTD.) 12 June 2013 (12.06.2013), entire document	1-11
A	CN 205039440 U (XIAMEN WILSONS ELECTRICAL CO., LTD.) 17 February 2016 (17.02.2016), entire document	1-11
A	CN 103762512 A (HU, Guangfu) 30 April 2014 (30.04.2014), entire document	1-11

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 March 2018	12 April 2018
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer CAO, Yang Telephone No. (86-10) 53961232

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/092461

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